QT

- REGULATED POWER SUPPLIES
- ELECTRONIC INSTRUMENTS

Quan-Tech

LABORATORIES INC.

BOONTON, N. J.

REPRESENTED BY

A-F SALES ENGINEERING, INC.

94 SOUTH LOS ROBLES AVENUE

PASADENA, CALIFORNIA

MUrray 1-5631

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_06468

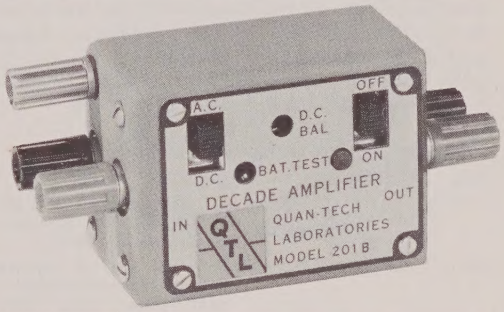
Quan-Tech LABORATORIES

SOLID STATE AMPLIFIERS

Quan-Tech's fully transistorized amplifiers are highly compact, ruggedly constructed units that offer excellent performance at modest cost.

It should be noted that all critical resistors as well as all solid state components in these amplifiers have been selected for low noise in accordance with Quan-Tech's stringent noise specifications. This inspection is responsible not only for the very low noise levels that characterize Quan-Tech amplifiers, but also contributes substantially to the excellent record for reliability that these amplifiers have achieved for themselves in the field.

MODEL 201B: DC Decade Amplifier



Extends sensitivity of an oscilloscope, recorder, counter, etc. by a fixed factor of 10 over bandwidth from dc to 3mc; very low noise level of Model 201B permits using two or even three amplifiers in many applications for gains of 100 or 1000. With appropriate adaptor plug (see reverse side) amplifiers may be plugged directly into input terminals of associated instrument. Powered by self-contained long-life batteries, Model 201B may be operated ungrounded. Separate ground connection to outside case permits floating operation if desired. Positive battery test indicator included.

SPECIFICATIONS

VOLTAGE GAIN: 10:1 ± 2%

FREQUENCY RESPONSE: Flat within ± 2% DC to 100 Kc; ± 0.5 db at 1Mc; −3 db at approximately 3Mc.

AC coupled flat within ± 2% 30 cycles to 100Kc; 0.5 db at 1Mc; −3 db at approximately 3 Mc.

NOISE: Equivalent broad band input noise (10~to 3Mc) less than 30 RMS μv with input shorted

Typical narrow band input noise voltage 2×10^{-8} RMS volts, noise current 4×10^{-12} RMS amperes per root cycle above 1Kc.

INPUT IMPEDANCE: Approximately 250K ohms shunted by 30 $\mu\mu$f.

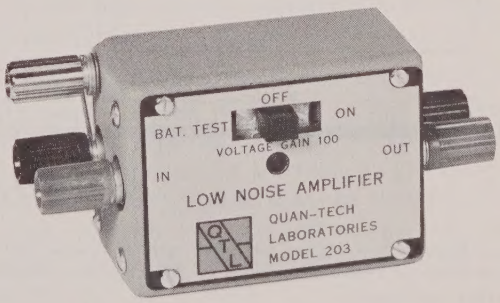
OUTPUT IMPEDANCE: Nominally less than 100 ohms.

MAXIMUM OUTPUT VOLTAGE: 1 volt peak-to-peak.

BATTERY LIFE: Approximately 600 hours with Mercury batteries.

DIMENSIONS: 1 5/8" x 2" x 4 1/4", overall.

MODEL 203: Low Noise, High Gain AC Amplifier



Provides a fixed gain of 100 over frequency range from 30 cps to 500 kc; extremely valuable for extending sensitivity of a great variety of laboratory instruments. Noise level in Model 203 is so low that in a great many applications two amplifiers may be used in tandem for a total gain of 10,000. Using appropriate adaptor plug (see reverse side) Model 203 may be plugged directly into input terminals of associated instrument.

Model 203 contains its own mercury-battery supply and battery test indicator. Separate ground connection is provided for off-ground operation.

SPECIFICATIONS

VOLTAGE GAIN: 100:1 ± 0.5 db.

FREQUENCY RESPONSE: Flat within ± 0.5 db 30 cycles to 100 KC; −3 db. at approx. 500 KC.

INPUT IMPEDANCE: Approximately 80,000 ohms shunted by 10 $\mu\mu$f.

OUTPUT IMPEDANCE: Less than 100 ohms.

MAXIMUM OUTPUT VOLTAGE: 1 volt peak-to-peak.

NOISE: Equivalent broad-band input noise (10~to 500 Kc) less than 5 RMS μv input shorted.

Typical narrow band input Noise Voltage: 5×10^{-9} RMS volts, Noise current: 3×10^{-12} RMS amperes per root cycle above 1Kc.

DISTORTION: Less than 0.5% at rated output.

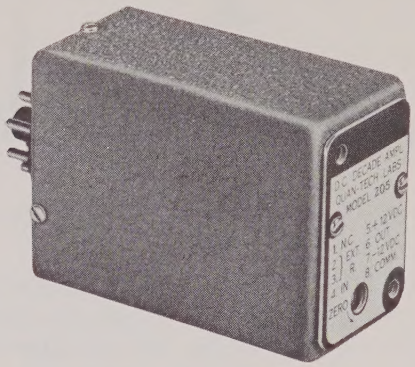
BATTERY LIFE: Approximately 500 hours with 3 type ZM9 mercury batteries.

DIMENSIONS: 1 5/8" x 2" x 4 1/4", overall.

WEIGHT: 8 ozs.

solid state amplifiers

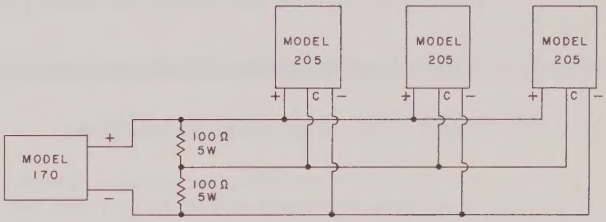
MODEL 205:
High-Stability DC Amplifier



Provides fixed gain of 10 from dc to 500 kc; with stability approaching that of far more expensive chopper-stabilized units. Completely self-contained except for primary power. All input and output connectors brought out through standard octal plug; mounting holes provided for fixed installation. Provision also included for remote zero-adjust.

Both electrically and mechanically, Model 205 is extremely well adapted for use in banks in conjunction with, for example, multi-channel recorder.

The Model 205 requires an external source of + and −12 volts for operation. The Quan-Tech Model 170 Modular Power Supply is particularly well suited for this purpose. The Model 170 will power up to three 205's (See diagram at right) and two Model 170's will power up to 10. Model 170's are available with connections brought out to terminal strip (Version T), octal plug (Version C), or to conventional ¾-inch-spaced binding posts (Model B), as the particular installation requires.



SPECIFICATIONS

VOLTAGE GAIN: 10 ± 2%

FREQUENCY RESPONSE: DC to less than 0.5 db down at 100 KC, −3 db down at approximately 500KC.

INPUT IMPEDANCE: Approx. 250 K shunted by 50 μμf, Recommended source resistance: Less than 1000 ohms.

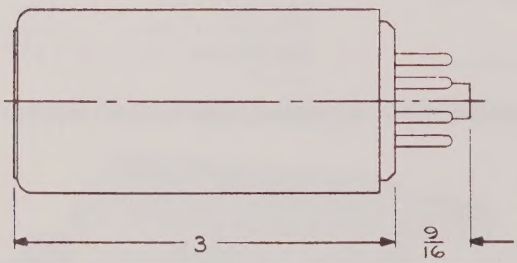
OUTPUT IMPEDANCE: Less than 100 ohms at 1KC.

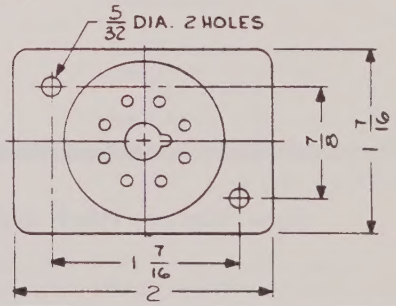
MAXIMUM OUTPUT VOLTAGE: 5 volts peak-to-peak.

DISTORTION: Less than 1% at rated output.

STABILITY: Typical Drift: Less than 3mv, 70° to 120° F, shorted input; at constant ambient temperature, less than 250 μv per day referred to the input.

MECHANICAL SPECIFICATIONS





ACCESSORY ADAPTOR PLUGS

Specially designed adaptors are available for convenience in connecting 201B or 203 amplifier directly to other equipment.

TYPE 1001 Adaptor: Banana-to-banana, for connecting amplifier into standard ¾" binding posts, or for connecting amplifiers in tandem.

TYPE 1002 Adaptor: Banana plug to UHF connector, for connecting to tektronix scopes, etc.

TYPE 1003 Adaptor: Banana plug to BNC connector for connecting to counters, etc.

SPECIALLY DESIGNED AMPLIFIERS

Quan-Tech's substantial accomplishments in the areas of very-low-level signal handling, combined with extensive experience in noise problems of components, instruments and systems, provide a truly unique background for the creation of highly specialized amplifiers. Quan-Tech invites the opportunity to design, develop and produce such amplifiers to individual needs.

For information, write, outlining your requirements, to Quan-Tech Laboratories at the address below.

QUAN-TECH LABORATORIES, INC., BOONTON, NEW JERSEY

PRINTED I

Quan-Tech LABORATORIES

MODEL 301 AC MICROAMMETER

The Model 301 AC Microammeter brings to the engineer investigating transistor and magnetic circuits a tool as fundamental to his needs as the familiar VTVM is to those working with vacuum tubes. The necessity of AC current measurements is ever increasing with the growth of solid state and magnetic devices. In many of today's circuits, the very low impedances and non-linearities make current measurements mandatory.

Even though the engineer has been aware of the need for current measurements he has, until now, been forced to use the cumbersome voltmeter-resistor method. Due to the high input impedance and capacitive loading of the ground terminal, this method of measurement has been makeshift at best. The Quan-Tech Model 301 gives the engineer for the first time an instrument having the desirable features of a laboratory AC current meter. Low input impedance, high sensitivity, and isolation from ground permit low-level current measurements to be made without disturbing the circuit under test.

DESCRIPTION

The basic instrument consists of a six stage transistor amplifier arranged in pairs. Each pair has 100% negative current feedback to insure maximum stability of gain and linearity of metering. Direct coupling is used throughout, providing freedom from temperature drift. Additional stability against line transients is obtained by a transistorized regulated power supply.

An oscilloscope connection is provided for measurement and observation of current wave forms. The metering system is of the average type calibrated in RMS microamperes for a sine wave.

There are two probes supplied with each instrument, a clamp-on probe and an insertion or series probe. In addition, there is a high current clamp-on probe available as an accessory.

The Standard clamp-on probe permits rapid measurement of currents in the 300 ua to 100 ma range. It is carefully constructed of high permeability magnetic material, and the mating surfaces are lapped to insure minimum leakage. A secondary winding on the core makes the probe into a current transformer having a 1 to 100 turns ratio when clamped around a wire. The effective insertion impedance is less than 10^{-3} ohms.

The insertion or series probe consists of a current transformer enclosed in a Mu Metal shield to minimize stray magnetic pick-up. Two separate primaries provide turns ratios of 1 to 1 and 1 to 100. The 1 to 1 ratio permits measurement of levels down to 3 ua full scale, with an input impedance of approximately 2 ohms and a noise level of less than 0.1 ua. The 1 to 100 ratio permits measurements to 100 ma with an input impedance of a few milliohms.

The high current clamp-on probe is similar to the standard clamp-on probe, but is slightly larger and made of a high flux density material. It may be used directly into the instrument, providing better low frequency response than the standard clamp-on probe, or with the 1 to 100 ratio of the insertion probe. The latter connection allows current measurements up to 10 amperes.

Applications

Magnetic and solid state devices are often characterized by very low impedances and extremely nonlinear voltage-current characteristics. The Model 301 is an ideal instrument for the investigation of such devices, since it can measure currents and display on an oscilloscope actual current waveforms without introducing undesirable impedances in the circuit under test.

Transistor Circuits

In addition to measuring the currents in the various branches of a transistor circuit, the Model 301 may be used to compute beta under actual operating conditions. With an appropriate oscillator, beta frequency cut-off of all but the highest frequency transistors may be measured. In push-pull amplifiers, dynamic current balance can be checked.

Magnetic Circuits

The Model 301 is very useful in magnetic amplifier investigation. Since both the clamp-on and the insertion probe are isolated from ground, the current at any point in the circuit may be measured without grounding problems. With a suitable driver it can be used for matching cores for critical applications. It has ample sensitivity to measure playback as well as recording currents in magnetic recording heads.

Miscellaneous Applications

In addition to the commoner uses of the Model 301, there are a number of other applications where it is useful. It can be used as an extremely sensitive null indicator for AC bridges, etc., or as a low impedance differential amplifier and meter.

SPECIFICATIONS

SENSITIVITY:

Insertion probe — 3 ua to 100 ma full scale.

Clamp-on probe — 300 ua to 100 ma full scale.

10 amp clamp-on probe — 300 ua to 10 amps full scale (with direct connection and 100 multiplier of insertion probe.)

ACCURACY:

Insertion probe — ±2% of full scale at 1 KC.

Clamp-on probes — ±5% of full scale at 1 KC.

FREQUENCY:

Insertion probe — Flat within ±2% 50 cycles to 100 KC, 3db down at approximately 10 cycles and 1 MC.

Clamp-on probe — ±5% 100 cycles to 100 KC, 3db down at approximately 50 cycles and 1 MC.

10 amp Clamp-on probe — ±5% 50 cycles to 50 KC, 3 db down at approximately 10 cycles and 150 KC (with 100 multiplier.)

INPUT IMPEDANCE:

Insertion probe — Approximately 2 ohms plus 8 uh, 60 mmf to ground from 3 ua to 1 ma. A few milliohms 300 ua to 100 ma.

Clamp-on probe — Less than 10^{-3} ohms.

10 amp clamp-on probe — Less than 10^{-3} ohms. (direct connection). Unmeasurable with 100 multiplier.

METER RANGES: 3, 10, 30, 100, 300, and 1000 ua full scale.

OSCILLOSCOPE CONNECTION: Full scale output — approximately 0.1 volts rms into 10 K ohm load.

DIMENSIONS: 8¼" high, 5" wide, 6¾" deep overall. Weight 5 pounds.

POWER: 115 volts 50 - 60 cycle, 2 watts.

QUAN-TECH LABORATORIES INC.

60 Parsippany Boulevard, Boonton, N. J.

Phone: DE 4-8500

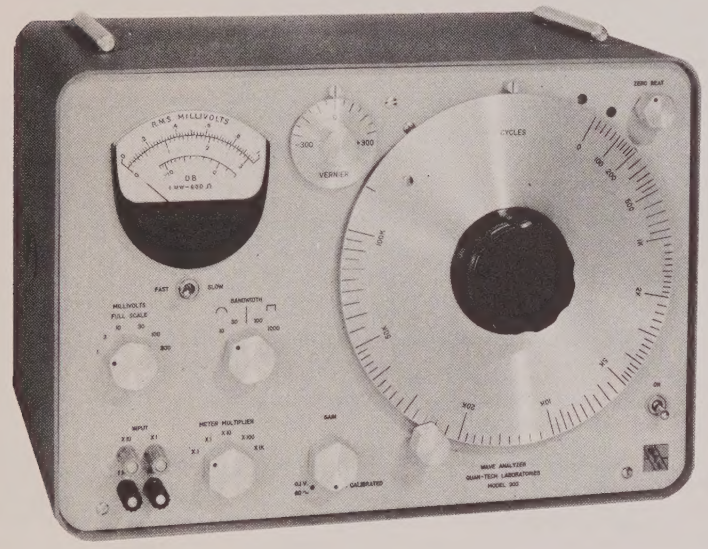
PRINTED IN U.S.A.

Quan-Tech

LABORATORIES

Boonton, New Jersey

MODEL 303
WAVE AND NOISE SPECTRUM ANALYZER



technical summary

- ★ Completely transistorized
- ★ Frequency range 30 cps to 100 kc
- ★ Selection of four constant bandwidths: 10, 30, 100 and 1000 cps
- ★ Flat-topped on broad bandpass positions
- ★ Highly sensitive and versatile
- ★ Simplified tuning including vernier
- ★ Metering circuits compensated to minimize error on instantaneous noise pulses
- ★ Errors from drift and flutter eliminated
- ★ Long and short meter time constants selectable
- ★ Warm-up essentially instantaneous
- ★ Analog outputs provided for external monitoring
- ★ Lightweight and compact

GENERAL: The Model 303 is a fully transistorized, highly compact instrument for making frequency-spectrum analyses of repetitive or random signals from the audio range through to the ultra-sonic region. The Model 303 embodies a number of unusual features that contribute greatly to the accuracy, speed and convenience of spectrum measurements over a very broad range of applications.

FOUR FIXED BANDPASSES: The Model 303 offers front-panel selection of four fixed bandpasses instead of the usual single, narrow bandpass. This enables a number of spectrum measurements which otherwise would be difficult or impossible.

In any area of instrumentation it is desirable to have as broad a bandpass as possible to pass the greatest possible amount of information. In spectrum analysis, however, the need for a very narrow bandwidth to permit separation of closely spaced frequency components complicates matters.

Various means have been adopted to overcome this difficulty. For example, one approach has been to use a single narrow bandpass, plus an automatic frequency control to "hold-in" a signal that might otherwise drift in and out of the narrow "measuring slot". This system is adequate so long as the variations in frequency of the signal under study are within the "hold-in" range and the response time of the AFC circuit. However, in practical usage, signals are frequently encountered that vary beyond these limits. The result is a very substantial loss of accuracy of measurement.

Quan-Tech's approach, employing selection of four fixed bandpasses (10, 30, 100 and 1000 cps) overcomes this difficulty by enabling the operator to match the bandwidth of the system to the requirements of the signal under study.

In addition, this arrangement adds greatly to the speed and convenience of tuning the Model 303, since the signal under investigation may be located through a wide-band "viewing slot" rather than through one only a few cycles wide. Once the signal is located and centered, the operator then simply switches down to the appropriate narrower-bandpass position.

FREQUENCY RANGE – 30 CPS TO 100 KC: Frequency range of the Model 303 extends out to 100 kc – far beyond the capabilities of the more conventional audio-frequency spectrum analyzers. This substantially greater range permits investigations up into the ultrasonic region, and also enables study of the harmonic content of many signals, which, while essential to complete wave-spectrum analysis, is wholly beyond the capabilities of more limited equipment.

Additional Features

SELECTION OF METER TIME CONSTANTS: A front-panel switch selects either long or short meter time constants. The short time constant is useful for signals whose amplitudes are fairly stable. The long time constant is extremely valuable for averaging of such rapidly varying quantities as noise or vibration amplitudes. Dynamic overload point of the metering circuits is greater than 10 times full scale to minimize error on instantaneous amplitude peaks. The meter movement is diode-protected against damage from overload.

FREQUENCY VERNIER: Front-panel vernier provides a continuous, calibrated, fine frequency adjustment of up to plus or minus 300 cycles which is particularly useful for fine tuning at the higher range of frequencies.

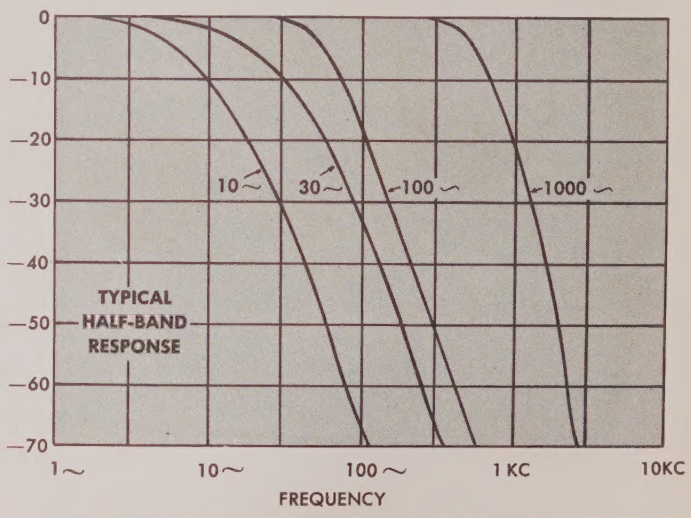
DC OUTPUTS: Two outputs are available from rear panel connectors: a DC analog of meter deflection and one of angular position of the main tuning dial. These are valuable for graphic displays of frequency spectra on an oscilloscope or X-Y plotter.

Recommended Accessories

MODEL 203 LOW-NOISE AMPLIFIER: Sensitivity of the Model 303 may be extended by a factor of 100 (from 100 μv to 1 μv full scale) through use of a Quan-Tech Model 203. This miniature solid-state amplifier may be plugged directly into the input terminals of the Model 303, thus requiring no additional bench space. The Model 203 is completely self-contained and requires no connections beyond the signal input.

TYPE 1110 DRIVE MOTOR: Easily attached or removed from the case of the Model 303, the Type 1110 provides a convenient means for automatic, continuous sweep of the entire frequency range of the Model 303, or any portion of this range. Sweep speeds of 1.6 or 0.25 rpm may be selected. Other sweep speeds are available on special order.

MODEL 317 AMPLITUDE DISTRIBUTION ANALYZER: Complementing the Model 303, the Model 317 completes the signal analysis by providing for the determination of amplitude distribution. Especially valuable for noise and vibration studies. Full specifications available on request.



SPECIFICATIONS

FREQUENCY

Range: 30 cycles to 100 Kc.
Dial Calibrations: Approximately logarithmic.
Accuracy ±5% or 10 cycles.
Vernier Frequency Dial: ±300 cycles.

SELECTIVITY

Four fixed bandwidths selectable from front-panel switch:

Round-Top, Synchronous Tuned

10 cycles (±5 cycles) at 3 db points
30 cycles (±15 cycles) at 3 db points

Flat-Top (Butterworth Approximation)

100 cycles (±50 cycles) at 3 db points.
Approximately 2% down at ±25 cycles.
1000 cycles (±500 cycles) at 3 db points.
Approximately 2% down at ±250 cycles.

METER CIRCUIT

Average type calibrated RMS for sine wave. Linear for instantaneous peaks 20 db in excess of full scale for accurate noise analysis. Meter movement diode protected. Time constants of approximately .01 and 1 second provided by front panel switch.

VOLTAGE

Range: 100 μv to 300 volts full scale.
Input Attenuator: 0.1, 1, 10, 100, 1K plus 20 db continuously variable gain.
Meter Attenuation: 1, 3, 10, 30, 100, 300 millivolts.
Accuracy: ±5% of full scale.
Spurious Modulation Products and Hum: More than 70 db down.

INPUT IMPEDANCE

100K ohms or 1 megohm with 10 to 1 attenuation.

ANALOG OUTPUTS

0 to 1 volt positive proportional to meter deflection. Minus 20 volts to 0 volts approximately, proportional to tuning dial angle from 0 cycles to 100 Kc.

POWER

105 to 125 or 210 to 250 volts AC, 50-400 cycles, 6 watts. May be battery operated.

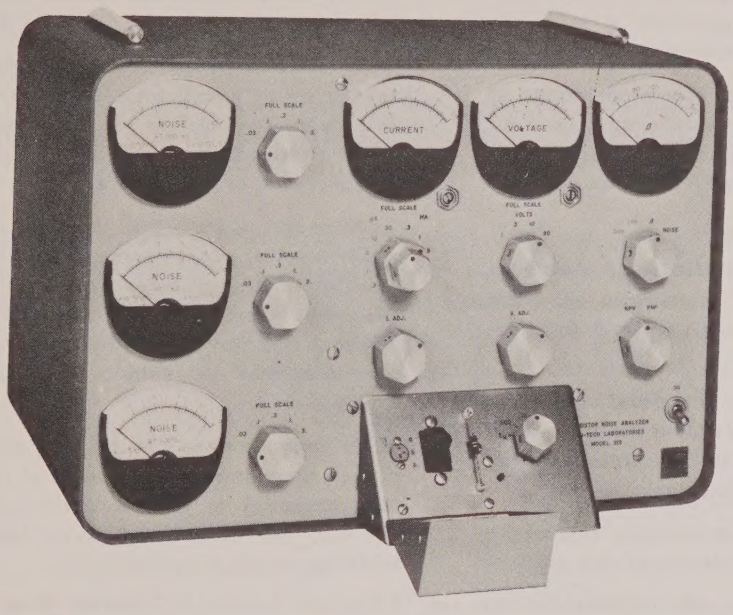
DIMENSIONS

Height 10½", Width 14", Depth 11¼" overall. Weight 28 pounds.

QUAN-TECH LABORATORIES, INC.
Boonton, New Jersey

Printed in U.S.A.

Quan-Tech LABORATORIES



MODEL 310
TRANSISTOR NOISE ANALYZER

GENERAL INFORMATION

The Model 310 is a compact bench size unit that provides rapid and accurate quantitative measurement of the electrical noise generated within a transistor. Measurement is made at three frequencies (100 cps, 1000 cps and 10kc) simultaneously, thus providing a three-point spectrum analysis of the transistor noise characteristic. Measurement of both noise voltage and noise current may be made, permitting prediction of noise figure for any specific input impedance. Two resistors (500 and 1000 ohms) are incorporated in the Model 310 for making noise figure measurements, and provision is included for connection of an external resistance for specialized needs.

As an added convenience the Model 310 also measures I_{cbo}, I_{ebo}, and Beta.

Operation of the Model 310 is simple, and noise measurement may be made in a matter of seconds, suiting the instrument for production-line applications as well as for laboratory use.

From the standpoint of the transistor manufacturer, the Model 310 is an invaluable tool for quality-control applications as well as for basic research. Moreover, the Model 310 enables the manufacturer to specify in unequivocal terms the amount of noise generated by his devices.

From the standpoint of the equipment manufacturer, the Model 310 permits culling out noisy transistors at incoming inspection before they can be installed in equipment, where they would degrade performance and jeopardize reliability.

TRANSISTOR NOISE AND CIRCUIT PERFORMANCE

During several years of intensive research into transistor circuit operation by Quan-Tech Laboratories, it was discovered that the electrical noise characteristics of transistors differ widely, not only between transistors of different types, but also between transistors of the same type, same manufacturer and even of the same production batch. In the production of low-level

(continued on Reverse Side)

or high-precision circuits the noise generated by transistors (which test "good" in every other respect) can introduce very severe performance problems.

Once an excessively noisy transistor is installed in a circuit, locating and replacing the offending component during some phase of production or final test is generally a very time consuming and expensive operation.

Thus it has been found that preselection of transistors for noise substantially up-grades the performance of production units and greatly reduces expensive testing and re-work time.

NOISE AND RELIABILITY

The cumulative effects ofnoise upon ultimate performance (i.e. loss of information, introduction of error, impaired stability, etc.) are quite broadly recognized.

However, the presence of unusual amounts of noise in a transistor carries other implications of importance to those who are concerned with the reliability of electronic equipment.

Noise in a transistor appreciably beyond the level that is normal for a device of that particular type is generally found to stem from a defect in material or manufacture.

It is known that "excess", or 1/f, noise in a semi-conductor material is essentially proportional to current density. Where a fracture, void, or leakage path occurs a local area of high current density is developed and excess noise in addition to that normal for the device is generated.

In practical usage, abnormally high levels of excess noise usually are found to result from such defects as surface contamination, fractures of the semiconductor material, irregularities in the junctions, or defective welds.

Whenever a transistor is found to exhibit a higher level of excess noise than is the norm for a device of its particular type, it is safe to assume that some sort of defect or abnormality is present, and for any critical application, that component may be justly suspected as a reliability risk.

In summation, it may be said that preselection of transistors on the basis of noise is not only essential to the production of low-noise circuits, but also is of major importance in achieving maximum reliability.

For further details regarding transistor noise see: "A Practical Approach to Transistor Noise" Published by Quan-Tech Laboratories. Copies available on request from address below.

SPECIFICATIONS

NOISE:

Range: 0.01 to 3 microvolts per root cycle, full scale.
1 to 300 pica-amperes per root cycle, full scale.

Accuracy: ±1 db.

Noise threshold at collector of test socket is less than: at 10 KC: 5 pa/root cycle
at 1 KC: 7 pa/root cycle
at 100 cps: 12 pa/root cycle

SPECTRUM ANALYSIS:

Noise measurement at three frequencies simultaneously: 100cps, 1kc and 10kc. Noise readings referred to the input of the transistor under test with an equivalent bandwidth of 1 cycle.

COLLECTOR VOLTAGE:

Range: 0.1 to 30 volts.

Meter Ranges: 1, 3, 10 and 30 volts, full scale.

Accuracy: ±5% + .1v of full scale.

COLLECTOR CURRENT:

Range: 0.05 to 30 milliamperes.

Meter Ranges: 0.3, 1, 3, 10 and 30 milliamperes, full scale.

Accuracy: ±5% of full scale.

LEAKAGE CURRENTS (I_{cbo}, I_{ebo}):

Meter Ranges: 0.3, 1, 3, 10 and 30 microamperes, full scale.

Accuracy: ±5% of full scale.

BETA:

Range: 10 to 300 (measured at 4kc.)

PHYSICAL SPECIFICATIONS:

11" H x 15" W x 11" D.

Weight: 40 pounds.

POWER INPUT:

117/234 volts, 60cps, 30 watts.

MODEL 311: Similar to above, except that Collector Current Range extends from 5 to 1000 microamperes. Collector Current Meter Ranges are: 10, 30, 100, 300 and 1000 microamperes, full scale; I_{cbo} and I_{ebo} Meter Ranges: 0.03, 0.1, 0.3, 1, and 3 microamperes. Beta measurement is not available in the Model 311.

– Specifications subject to change without notice. –

QUAN-TECH LABORATORIES INC.
60 Parsippany Boulevard, Boonton, N. J.
Phone: DE 4-8500

PRINTED IN U.S.A.

CP-7-5K-1-62

QUAN-TECH MODEL 311

LOW-CCLLECTOR-CURRENT TRANSISTOR NOISE ANALYZER

Tentative Data

The Model 311 is similar to the Quan-Tech Model 310 Transistor Noise Analyzer, except that the Model 311 is intended specifically for analyzing noise in low-collector current devices, such as certain silicon transistors.

Like the Model 310, the Model 311 provides a three-point noise-spectrum analysis (at 100, 1000, and 10,000 cps). Measurement of both noise current and noise voltage is provided so that noise figure for any given input impedance may be predicted. As with the Model 310, measurements of I_{cbo} and I_{ebo} are included. (Note: Beta measurement, provided in the Model 310, is not available in the Model 311.)

Specifications

NOISE:

Range: 0.01 to 3 microvolts per root cycle, full scale.
1 to 300 pica-amperes per root cycle, full scale.
Accuracy: ≠ 1 db
Noise Threshold: At collector of test socket, less than:

at	10 KC:	2 Pa./root cycle
at	1 KC:	2 Pa./root cycle
at	100 cps:	4 Pa./root cycle

SPECTRUM ANALYSIS:

Noise measurement at three frequencies simultaneously: 100 cps, 1 KC and 10 KC. Noise readings referred to the input of the transistor under test with an equivalent bandwidth of 1 cycle.

COLLECTOR VOLTAGE:

Range: 0.1 to 30 volts
Meter Ranges: 1, 3, 10 and 30 volts, full scale
Accuracy: ≠ 5% of full scale

CCLLECTOR CURRENT:

Range: 5 to 1000 microamperes
Meter Ranges: 10, 30, 100, 300 and 1000 microamperes, full scale
Accuracy: ≠ 5% of full scale

LEAKAGE CURRENTS(I_{cbo}, I_{ebo}):

Meter Ranges: 0.03, 0.1, 0.3, 1, and 3.
Accuracy: ≠ 5% of full scale.

PHYSICAL SPECIFICATIONS:

11" h. x 15" w. x 11" d.
Weight: 40 pounds

POWER INPUT:

105 - 125 volts, 60 cps, 30 watts

QUAN-TECH LABORATORIES, Inc.
60 Parsippany Boulevard Boonton, New Jersey
Phone: DE 4-8500

MODEL 315 RESISTOR-NOISE TEST SET

features

- ★ *Quantitative* measurements of excess resistor noise.
- ★ Tests *any* resistor from 100 ohms to 22 megohms.
- ★ Compact, completely self-contained unit.
- ★ Accuracy of noise measurement, ±5%.
- ★ Simple operation; readily adaptable to production-line testing.
- ★ Variety of signal outputs for data processing, driving external monitors.

The Model 315 is a compact, bench-size instrument for making precise quantitative measurements of excess resistor-noise. The index of measurement is microvolts-per-volt in a decade of frequency, as recommended by the National Bureau of Standards.*

Of great value both to the manufacturer and user of resistors, the Model 315 provides for the first time a commercially available instrument for determining accurately, and in accordance with widely accepted standards, the excess noise generated by current in resistors.

Operation of the Model 315 is extremely simple, and lends itself well to production-line testing as well as to laboratory use. The resistor to be tested is placed in the test jig.** Resistor noise is read as the difference between two meter readings. Calibration and applied voltage need be adjusted only when the ohmic value of the resistor to be tested differs from that of the previous test.

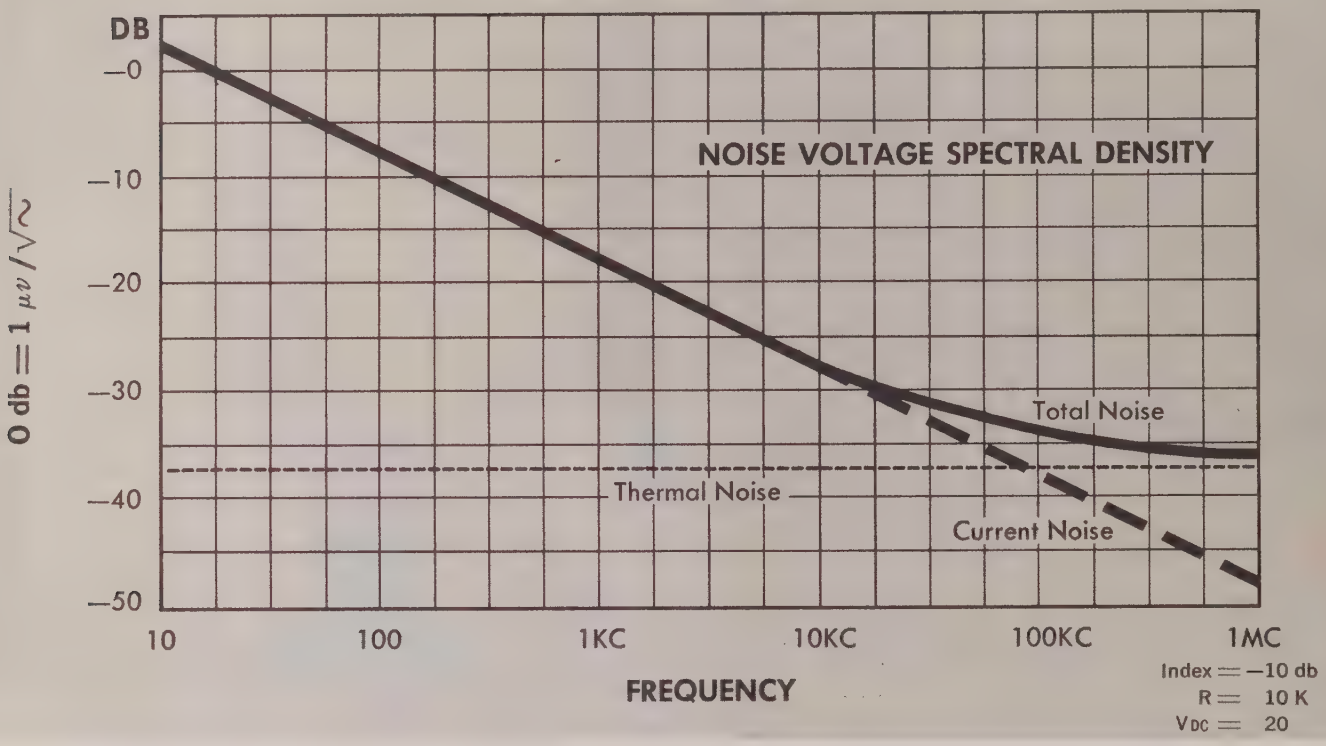
Three outputs are available from jacks at the rear of the Model 315: a dc analog of the applied voltage, dc analog of the noise magnitude, both of which are valuable for data processing, and an ac output of the noise alone which may be applied to an oscilloscope or monitored aurally.

*See: "A Recommended Standard Resistor Noise Test System," G. T. Conrad, Jr., N. Newman, & A. P. Stansbury; I.R.E. Transaction of the Professional Group on Component Parts; Vol. CP-7, No. 3, Sept. 1960. Reprint available from Quan-Tech Laboratories on request.

**For special applications, an optional remote sensing cable is available.

Quan-Tech LABORATORIES

ACCURATE, QUANTITATIVE MEASUREMENT OF



GENERAL NOISE DISCUSSION

The limitation in sensitivity of electronic systems owing to *noise* has been known for a number of years. Although most engineers are familiar with the noise generated in vacuum tubes, the types or magnitudes of noise generated in other electronic devices (semi-conductors, electrolytic capacitors, and current carrying resistors, for example) are far less widely recognized. One of the less recognized (although extremely important) sources of noise is the current carrying resistor.

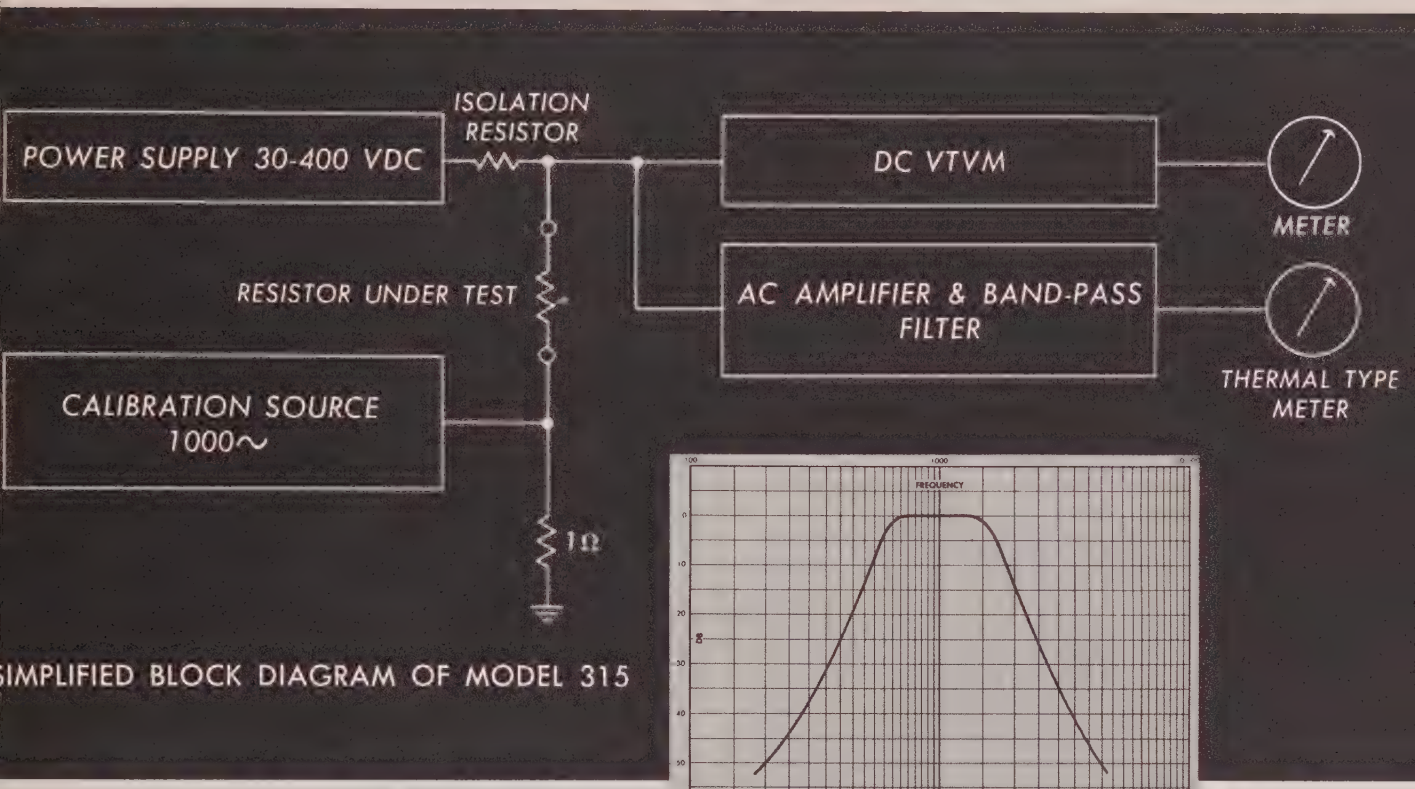
All resistors generate a fluctuation voltage, commonly called "Thermal Noise," in an amount equal to a theoretical value, determined by the resistance, the bandwidth and the absolute temperature. Virtually all composition and deposited-film resistors, as well as defective wire-wound resistors, generate additional noise, often *many times* the theoretical value, when a voltage is applied across them. This noise, rather than tube or transistor noise, can often be the determining factor in establishing the noise figure of a circuit. The noise problem becomes especially acute in low-level audio and low-frequency circuits, since this excess noise exhibits a typical $1/f$ characteristic.

MODEL 315 APPLICATION

The Model 315 Resistor-Noise Test Set is designed to test resistors of all types from 100 ohms to 22 megohms, measuring noise voltages from 0.6 microvolts in a decade to 1000 microvolts in a decade. Bandwidth is 1000 cycles centered at 1 kc.

The simplified block diagram illustrates the fundamental principles of operation of the Model

RESISTOR-NOISE MADE QUICKLY AND EASILY



SIMPLIFIED BLOCK DIAGRAM OF MODEL 315

Frequency Response Characteristic of Band-Pass Filter

315. The dc supply provides a dc voltage variable from 30 to 400 volts to the test resistor and isolation resistor in series. The dc voltage across the test resistor is measured by the incorporated vacuum-tube voltmeter. The ac noise component is amplified, filtered and then metered by a thermal type meter.

The test system may be calibrated for different ohmic values of resistors by simple, front panel adjustments. Once calibrated, any number of resistors of a given resistance may be tested without need for re-calibration.

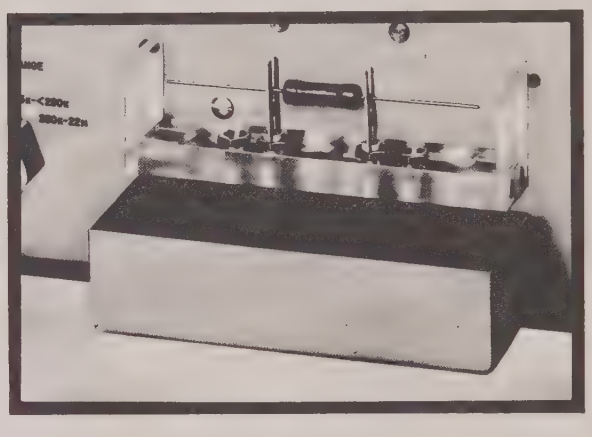
Absolute values of resistor noise in the standard index of measurement (microvolts per volt in a decade of frequency expressed in db) are made by subtracting the dc voltage reading from the noise-voltage reading.

For production or quality control testing, where the absolute noise value is not as important as assuring that no resistor of a batch exceeds a specific noise level, an output is available at the rear of the Model 315, to drive a go-no-go indicator. The AC noise output may be applied to an oscilloscope for visual monitoring or even to a pair of headphones for aural monitoring.

Where minimum noise and maximum reliability are of consequence, pre-selection of resistors with the Model 315 is of inestimable value.

For the resistor manufacturer, the Model 315 is an essential tool for assuring the high quality of his product, and enables him to specify the noise of resistors in conformance with widely recognized standards.

MODEL 315 RESISTOR-NOISE TEST SET



Close-up of jig showing resistor under test.

SPECIFICATIONS

RANGE:	Resistor Test Range	100 ohms to 22 meghoms.
	Noise Voltage	0.6 microvolts in a decade to 1000 microvolts in a decade.
	Applied DC Voltage	3 to 300 volts.
FILTER:	Geometric mean 1000 cycles, flat-topped bandpass.	
DETECTOR:	Pure RMS.	
OUTPUT:	Indicated for both noise voltage and applied DC voltage on separate panel meters as well as analog outputs for data processing. AC monitor jack included.	
ACCURACY OF NOISE VOLTAGE MEASUREMENT:	±5%.	
DIMENSIONS:	15"W x 11"H x 11"D overall, weight 30 lbs., completely self-contained.	
POWER INPUT:	117/234 volts, 50-60 cycles.	

REMOTE CABLE

permits operation of a test jig up to 10-feet distant from the instrument.

Quan-Tech Laboratories, leader in the field of component and system noise measurement and analysis, also makes available equipment for quantitative measurement in transistors and capacitors, as well as for Noise Spectrum Analysis. For information on such equipment, or for technical consultation on *your* noise problems, write to the address below.

QUAN-TECH LABORATORIES, INC.
Boonton, New Jersey

CP–7.5K–1–62

Prices and specifications subject to change without notice.

PRINTED IN

Quan-Tech LABORATORIES

MODEL 317

AMPLITUDE-DISTRIBUTION ANALYZER

FEATURES

- **Determines the amplitude-probability distribution of random signals**
- **Provides a particularly convenient means for determining whether the amplitude distribution of a random signal is Gaussian**
- **Reads directly in percent of time**
- **Switching rate, 5 mc**
- **Provision for plotting amplitude-distribution curve directly on scope**
- **Output provided to drive counter**

The Quan-Tech Model 317 determines the amplitude-probability distribution of random signals, and is extremely valuable in a great variety of applications, such as studies of noise or vibration, for determining threshold requirements, or for establishing false alarm or error probabilities. It is a very convenient means for determining whether the amplitude distribution of a random signal is Gaussian in nature.

Operation of the Model 317 is extremely simple. A voltage level is preset by a front panel control. The percentage of time that the applied signal exceeds the preset voltage level is then read directly from the scale. Three scale ranges are provided: 100%, 10% and 1% full scale. The unit may be switched to "inverted" operation which allows accurate measurement of small percentages of time the level is *not* exceeded.

AUTOMATIC AMPLITUDE-DISTRIBUTION PLOTTING

The voltage level of the Model 317 may be remotely controlled by applying an external signal to a rear-panel connector. In addition, a dc analog of the meter reading is available. Thus, by applying a sample of the sweep voltage of an oscilloscope to establish the voltage level, and then applying the dc analog to the associated scope, a plot of the amplitude distribution of the signal under study is automatically obtained.

The Model 317 is fully transistorized and is highly compact, occupying a minimum of bench space.

An output to drive a counter is available at a front-panel BNC connector for measuring the number of times the level is exceeded.

(See specifications on reverse side)

SPECIFICATIONS

SWITCHING RATE:	5 mc
PERCENT OF TIME RANGE:	100%, 10% and 1% full scale for both normal and inverted operation.
PERCENT OF TIME ACCURACY:	±3% of full scale.
INPUT LEVEL SENSITIVITY:	0.1* and 10 volts, peak-to-peak.
INPUT LEVEL ACCURACY:	±3% with variable attenuator full clockwise.
AMPLIFIER FREQUENCY RESPONSE:	±3%, 50 cps to 500kc; approx. -3db at 12cps and 1mc.
INPUT IMPEDANCE:	10K ohms / 50 μμf.
COUNTER OUTPUT:	Approx. 0.5 volt.
PRIMARY POWER:	~~105 – 125~~V, 50-60 cycles. Power consumption, ~~2~~ watts.
PHYSICAL DIMENSIONS:	8 1/4" h x 5" w x 6 3/4" d. Weight 5 lbs.

*Down to 0.001 volt with Quan-Tech Model 203 Low-noise Amplifier

QUAN-TECH LABORATORIES INC.
60 Parsippany Boulevard, Boonton, N. J.
Phone: DE 4-8500

PRINTED IN U.S.A.

5M-2-62CP

eem File System Sec. 2900
electronic engineers master

Quan-Tech
LABORATORIES, INC.
BOONTON, NEW JERSEY Code 201-334-8500

**MODEL 327
DIODE NOISE
ANALYZER**

MODEL 327 DOIDE NOISE ANALYZER

FEATURES

- Quantitative analysis of noise in back-biased diodes at two frequencies.
- Diode test voltage adjustable to 500 volts; current to 100 milliamperes.
- Fully adjustable steady-state, or automatic sweeping of diode test current and/or voltage.
- Variety of outputs for data logging or external monitoring.
- Single, compact, bench-size unit.
- Suitable for production use as well as for laboratory tests.
- Also useful for measuring noise in capacitors.

The Model 327 is a compact, bench-size instrument for the quantitative analysis of electrical noise generated within back-biased semiconductor diodes.

All current carrying solid-state components generate electrical noise. However, this noise (actually a composite of different types of noise generated by various internal mechanisms[1]) may vary broadly from one diode type to another. Also broad variations in type and amount of noise are found among units of the same type from different manufacturers, or even from the same manufacturer.

Excessive noise levels not only work to degrade the ultimate performance of the circuit[2], but also frequently indicate the presence of irregularities within the device — irregularities which experience shows render the device highly failure prone[3].

Thus, noise testing does far more than upgrade the performance of electronic equipment. Proper interpretation of noise analysis yields vital information on the internal condition of the diode, constituting a major step in the improvement of component reliability.

Model 327 — The Model 327 measures diode noise over a range of 0.03 microvolt to one millivolt (full scale) per root cycle at 10 cps and 1 kc simultaneously. The diode test voltage is adjustable up to 500 volts dc; and test current, up to 100 milliamperes.

1. See: "Electrical Noise and Component Reliability" published by Quan-Tech Laboratories, Inc. Copies available on request.
2. See: "Predicting DC Stability of Zener Diodes": A. P. Stansbury, Western Electronic News, July 1961.
3. See: Quan-Tech Technical Report, "Noise Analysis and Potential Failure Mechanisms in Semiconductor Diodes." Copies available on request.

Internal Current and/or Voltage Sweep — The current and/or voltage applied to the test diode may be swept by means of an internally generated ramp. Thus, the diode may be quickly and conveniently tested over a broad range of operating conditions. This is invaluable for the detection of multistate noise which usually occurs at several distinct levels of current or voltage, and may well not appear between these levels.

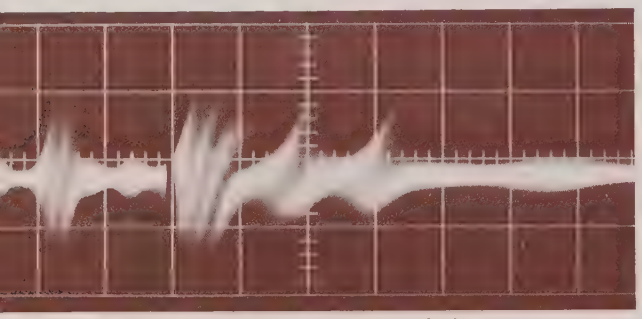
The ramp may be adjusted to sweep portions of the applied current or voltage within the maximum ratings of the instrument. It may be initiated manually for single-shot operation by a front panel switch, or set to sweep repetitively. Any of three ramp speeds may be selected by means of a front panel control.

Analog and Signal Outputs — Analogs of the 10 cps and 1 kc meter readings, of the applied test current and voltage, and of the impedance of the device under test are available at rear-panel terminals. These are useful for data logging or to actuate associated equipment.
In addition, the amplified 10 cps, 1 kc and broadband noise voltages are available at rear-panel terminals for monitoring on an oscilloscope.

Test Procedures — Operation of the Model 327 is extremely simple and convenient, and the instrument is very well suited for production line applications as well as for laboratory use. The desired test parameters, indicated by front-panel meters, are set up, and the diode is placed in the test jig. On closing the shield cover, the 10 cps and 1 kc noise levels are indicated directly in microvolts on front-panel meters. As an added convenience, diode impedance is also indicated. Aside from setting up the test conditions, no adjustments or calibration are required, and any number of similar diodes may be tested to these conditions without subsequent adjustment. The ramp, too, is completely controlled from the front panel, and may be switched in or out, from manual to automatic, from value to value or from speed to speed with a few simple adjustments.

In spite of its very great sensitivity, the instrument is not affected by reasonable environmental conditions, and may normally be used in the laboratory or production line without special shielding or shock mounting.

Capacitor Testing — The Model 327 may also be used for measurement of noise in capacitors, and will provide a quantitative analysis of, for example, corona noise, and impulse-breakdown noise, and, in electrolytic capacitors, low-frequency noise.



Unretouched oscillogram of noise vs. applied current in a zener diode. This plot was made by applying the broadband noise output to the vertical axis; the dc current analog to the horizontal axis. Note "bursts" of noise at the rather sharply defined current levels showing irregular diode breakdown. This diode has a high probability of premature failure. (Vertical scale, 1 mv/cm; horizontal scale, 1 ma/cm).

SPECIFICATIONS

NOISE RANGE:

0.03 microvolts to 1 millivolt RMS full-scale. (for $\triangle$ f=1 cycle)

BAND PASS:

Broadband amplifier response 5 cycles to 100 kc. Noise voltage measured at 10 cycles and 1 kc simultaneously.

DIODE TEST VOLTAGE:

0 to 500 volts, DC. Metered in five ranges: 10V, 30V, 100V, 300V and 1000V full-scale.

DIODE TEST CURRENT:

0 to 100 milliamperes, DC. Metered in nine ranges: 10 μa, 30 μa, 100 μa, 300 μa, 1 ma, 3 ma, 10 ma, 30 ma, and 100 ma full-scale.

RAMP:

Power supply swept by internal triangular reference waveform (appears as a voltage and/or current sweep depending upon test diode characteristics).

IMPEDANCE RANGE:

1 to 100 ohms

ANALOG OUTPUTS:

10-cycle noise, 1 kc noise, DC voltage, DC current, and impedance.

SIGNAL OUTPUTS:

10-cycle, 1 kc and broadband noise for oscilloscope presentation.

POWER INPUT:

115V, 50-60 cycles

DIMENSIONS:

11" High, 15" Wide, 11" Deep overall.

WEIGHT:

Approx. 55 Pounds.

PRINTED IN U.S.A.

Quan-Tech LABORATORIES

PRICE LIST

Effective December 1, 1962 (Supersedes issue dated April 26, 1962)

AMPLIFIERS

MODEL			
201B	D. C. Decade Amplifier	95.00	——
203	High-gain A. C. Amplifier	125.00	——
205	High-Stability D. C. Amplifier	105.00	——

INSTRUMENTS

		STANDARD	RACK MOUNTED
301	A. C. Microammeter	290.00	305.00
303	Wave and Noise Spectrum Analyzer	1425.00	1450.00
310	Transistor Noise Analyzer	2075.00	2105.00
311	Low-Current Transistor Noise Analyzer	2275.00	2305.00
315	Resistor Noise Test Set	1700.00	1730.00
317	Amplitude Distribution Analyzer	395.00	410.00
327	Diode Noise Analyzer	2450.00	2480.00
2136	Resistor Noise Test Set	2300.00	2330.00

ACCESSORIES

TYPE	USED WITH	UNIT PRICE
1001 Adapter (BP to BP)	201B/203	$ 2.00
1002 Adapter (BP to UHF)	201B/203	4.50
1003 Adapter (BP to BNC)	201B/203	4.50
1104 Ten Amp. Clamp-On Probe & Connector	301	65.00
1110 Drive Motor	303	75.00

- See reverse side for locations of Quan-Tech Sales Representatives.
- Prices listed are FOB Boonton, New Jersey, and are subject to change without notice.
- Terms of sale are 1% 10 days, net 30 days, subject to credit approval.
- All quotations will remain firm for a period of thirty (30) days unless otherwise specified in writing.

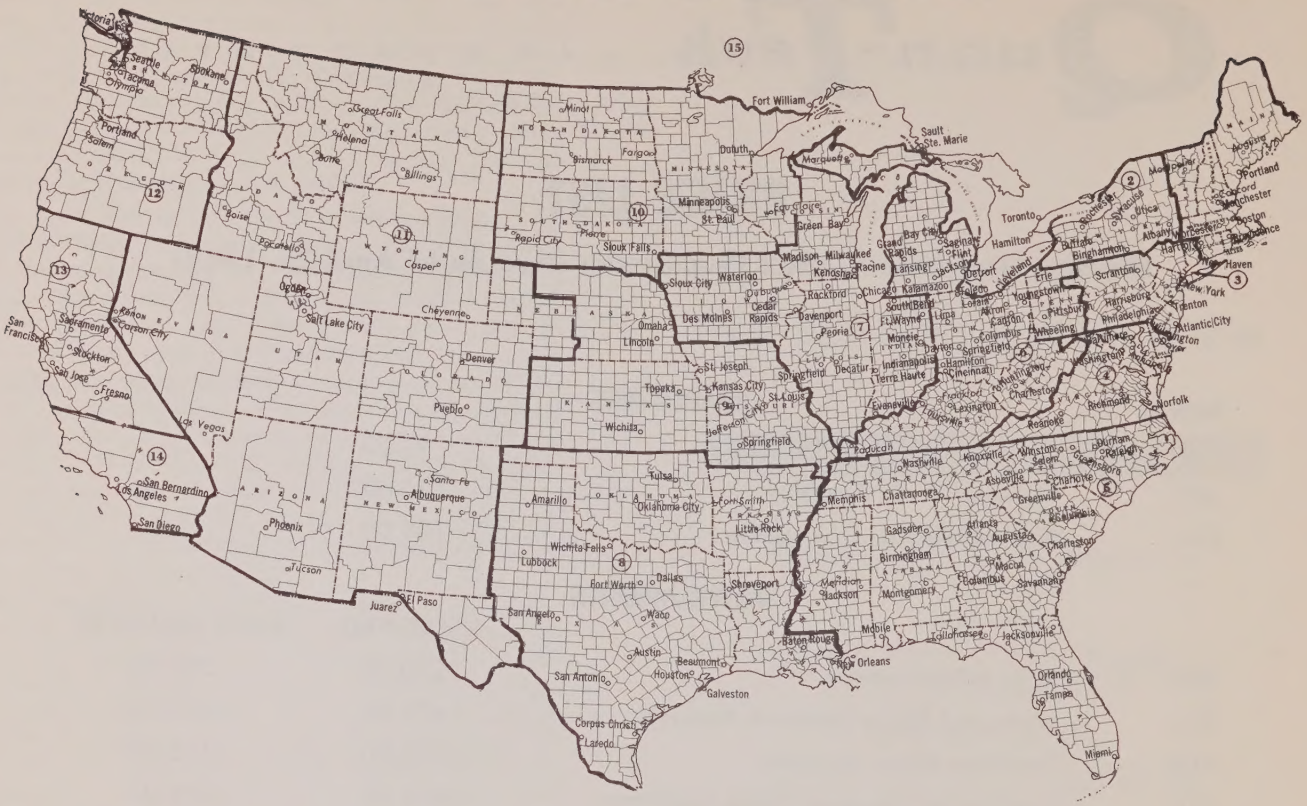
QUAN-TECH LABORATORIES INC.

60 Parsippany Boulevard, Boonton, N. J.

Phone: DE 4-8500

Printed in U.S.A.

QUAN-TECH SALES REPRESENTATIVES


Victoria
Seattle
Tacoma
Olympia
Spokane
Portland
Salem
Great Falls
Helena
Butte
Billings
Boise
Pocatello
Idaho Falls
Casper
Cheyenne
Ogden
Salt Lake City
Reno
Carson City
Sacramento
San Francisco
Stockton
San Jose
Fresno
Las Vegas
Denver
Pueblo
Santa Fe
Albuquerque
Phoenix
Tucson
San Bernardino
Los Angeles
San Diego
Juarez
El Paso
Amarillo
Lubbock
Wichita Falls
Abilene
Tulsa
Oklahoma City
Wichita
Topeka
Kansas City
Omaha
Lincoln
Des Moines
Sioux City
Sioux Falls
Rapid City
Pierre
Bismarck
Minot
Fargo
Duluth
Minneapolis
St. Paul
Fort William
Marquette
Sault Ste. Marie
Green Bay
Madison
Milwaukee
Racine
Kenosha
Waterloo
Dubuque
Cedar Rapids
Davenport
Rockford
Chicago
Peoria
Springfield
Decatur
St. Joseph
St. Louis
Jefferson City
Springfield
Fort Smith
Little Rock
Shreveport
Dallas
Fort Worth
Waco
Austin
San Antonio
Houston
Beaumont
Galveston
Corpus Christi
Laredo
San Angelo
Memphis
Paducah
Nashville
Chattanooga
Knoxville
Jackson
Meridian
Vicksburg
Baton Rouge
New Orleans
Mobile
Montgomery
Birmingham
Gadsden
Atlanta
Columbus
Macon
Augusta
Savannah
Charleston
Jacksonville
Tallahassee
Orlando
Tampa
Miami
Greenville
Spartanburg
Asheville
Charlotte
Winston-Salem
Greensboro
Raleigh
Durham
Norfolk
Richmond
Roanoke
Charleston
Lexington
Evansville
Indianapolis
Terre Haute
Cincinnati
Hamilton
Springfield
Dayton
Lima
Fort Wayne
South Bend
Kalamazoo
Lansing
Jackson
Detroit
Flint
Saginaw
Grand Rapids
Bay City
Toronto
Hamilton
Buffalo
Binghamton
Syracuse
Utica
Albany
Rochester
Portland
Concord
Manchester
Boston
Providence
New Haven
New York
Scranton
Harrisburg
Trenton
Philadelphia
Atlantic City
Wilmington
Baltimore
Washington
Cleveland
Akron
Canton
Youngstown
Pittsburgh
Wheeling
Erie
Toledo
Akron
Columbus
Springfield
Dayton
Cincinnati
Hamilton
Terre Haute
Indianapolis
Muncie
Lima
Fort Wayne
South Bend
Elkhart
Kalamazoo
Grand Rapids
Saginaw
Bay City
Flint
Detroit
Lansing
Jackson
Battle Creek
Kenosha
Racine
Milwaukee
Madison
Waterloo
Dubuque
Cedar Rapids
Davenport
Rockford
Chicago
Peoria
Springfield
Decatur
Jefferson City
St. Louis
Kansas City
Topeka
Wichita
Omaha
Lincoln
Des Moines
Sioux City
Sioux Falls
Rapid City
Pierre
Bismarck
Minot
Fargo
Duluth
Minneapolis
St. Paul
Fort William
Marquette
Sault Ste. Marie
Green Bay
Madison
Milwaukee
Racine
Kenosha
Waterloo
Dubuque
Cedar Rapids
Davenport
Rockford
Chicago
Peoria
Springfield
Decatur
St. Joseph
St. Louis
Jefferson City
Springfield
Fort Smith
Little Rock
Shreveport
Dallas
Fort Worth
Waco
Austin
San Antonio
Houston
Beaumont
Galveston
Corpus Christi
Laredo
San Angelo
Memphis
Paducah
Nashville
Chattanooga
Knoxville
Jackson
Meridian
Vicksburg
Baton Rouge
New Orleans
Mobile
Montgomery
Birmingham
Gadsden
Atlanta
Columbus
Macon
Augusta
Savannah
Charleston
Jacksonville
Tallahassee
Orlando
Tampa
Miami
Greenville
Spartanburg
Asheville
Charlotte
Winston-Salem
Greensboro
Raleigh
Durham
Norfolk
Richmond
Roanoke
Charleston
Lexington
Evansville
Indianapolis
Terre Haute
Cincinnati
Hamilton
Springfield
Dayton
Lima
Fort Wayne
South Bend
Elkhart
Kalamazoo
Grand Rapids
Saginaw
Bay City
Flint
Detroit
Lansing
Jackson
Battle Creek
Kenosha
Racine
Milwaukee
Madison
Waterloo
Dubuque
Cedar Rapids
Davenport
Rockford
Chicago
Peoria
Springfield
Decatur
Jefferson City
St. Louis
Kansas City
Topeka
Wichita
Omaha
Lincoln
Des Moines
Sioux City
Sioux Falls
Rapid City
Pierre
Bismarck
Minot
Fargo
Duluth
Minneapolis
St. Paul
Fort William
Marquette
Sault Ste. Marie
Green Bay
Madison
Milwaukee
Racine
Kenosha